Remarks

Applicants respectfully request reconsideration of the present application in view of the above amendment and following remarks. Claims 1, 5, 6, 8, 11 and 21 have been amended, and claims 24 and 25 have been added. No claims have been cancelled. Therefore, claims 1-25 are pending in the present application.

Claim 1 has been amended to state that a ratio of amounts of hydrocarbon fuel and hydrogen-containing fuel gas provided by the first and second systems to the engine is selected and controlled during an engine steady-state operating condition. *See Specification*, pg. 2, line 24-28; pg. 8, lines 9-12. Claim 5 has been amended to state that an optimum fraction of the motive energy of the engine is derived from the hydrocarbon fuel and the hydrogen-containing fuel gas when the engine reaches an equilibrium operating temperature. *See id.* Claim 6 has been amended to state that the optimum fraction is at least 90% hydrocarbon fuel. Claim 8 has been amended to correct a typographical error. Claim 11 has been amended to state that the engine is fueled by an optimum fraction of hydrogen-containing fuel gas at engine start-up and at engine steady-state operating conditions. *See id.* at pg. 2, lines 17-28; pg. 5, lines 22-30; pg. 8, lines 9-12. Claim 21 has been amended to state that the engine is fueled by an optimum fraction of hydrogen-containing fuel gas at engine start-up and at engine steady-state operating conditions. *See id.*

Claims 1, 2, 5-12, 14, 15 and 21-23 have been rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,524,582 to Suh et al. ("the Suh reference"). Also, claims 3, 4, 13 and 16-20 have been rejected under 35 U.S.C. §

103(a) as being unpatentable over the Suh reference. Applicants respectfully traverse the rejections to the remaining claims.

Amended claim 1 is directed to a method for fueling an internal combustion engine. The method includes the steps of providing a first fueling system for selectively metering a hydrocarbon fuel to the engine, providing a second fueling system for selectively metering a hydrogen-containing fuel gas to the engine, and selecting and controlling a ratio of amounts of hydrocarbon fuel and hydrogen-containing fuel gas provided by the first and second systems to the engine during an engine steady-state operating condition.

The Suh reference does not teach or suggest a method for fueling an internal combustion engine including the step of selecting and controlling a ratio of amounts of hydrocarbon fuel and hydrogen-containing fuel gas provided by the first and second systems to the engine during an engine steady-state operating condition as recited in amended claim 1. While the gaseous fuel supply may be utilized during the start-up phase in the Suh reference, the use of the gaseous fuel supply is phased out as the engine approaches steady-state operation. *See Suh*, Col. 4, lines 55-62; Col. 5, lines 25-27; FIGS. 2 and 3. Thus, the engine in the Suh reference solely relies on the liquid gasoline fuel supply during steady-state operation of the engine. *See Suh*, Col. 4, lines 62-64; Col. 5, lines 25-27. Since the engine in the Suh reference does not use the gaseous fuel supply during steady-state operation, the Suh reference does not teach or suggest the step of selecting and controlling a ratio of amounts of hydrocarbon fuel and hydrogen-containing fuel gas during an engine steady-state operating condition. Thus, Applicants request that the rejection

of claim 1 be withdrawn. As claims 2-4 depend from claim 1, these claims are also not taught or suggested by the Suh reference for at least the same reason set forth with respect to claim 1. Applicants request that the rejection of claims 2-4 be withdrawn.

Amended claim 5 is directed to a method for fueling an internal combustion engine with a hydrocarbon fuel and a hydrogen-containing fuel gas. The method includes the steps of starting the engine on a mixture of the fuel and the fuel gas wherein at least 90% of the motive energy of the engine is derived from the hydrogen-containing fuel gas, and progressively changing the supply ratio between the hydrocarbon fuel and the hydrogen-containing fuel gas. When the engine reaches an equilibrium operating temperature, an optimum fraction of the motive energy of the engine is derived from the hydrocarbon fuel and the hydrogen-containing fuel gas.

The Suh reference does not teach or suggest a method wherein an optimum fraction of the motive energy of the engine is derived from the hydrocarbon fuel and the hydrogen-containing fuel gas when the engine reaches an equilibrium operating temperature as recited in claim 5. In contrast, the engine in the Suh reference solely relies on the liquid gasoline fuel supply when the engine reaches an equilibrium operating temperature. *See Suh*, Col. 4, lines 62-64; Col. 5, lines 25-27. The engine in the Suh reference does not use the combination of the gaseous fuel supply and the liquid fuel supply after the engine is warmed-up. For at least this reason, Applicants request that the rejection of claim 5 be withdrawn. As claims 6-10 depend from claim 5, these claims are also not taught or suggest by the Shu

reference for at least the same reason set forth with respect to claim 5. Applicants request that the rejection of claims 6-10 be withdrawn.

Dependent claim 8 further distinguishes the present invention from the Suh reference. Claim 8 includes a first step of cranking said engine on a mixture of up to 100% of hydrocarbon fuel prior to said starting step, to optimize engine start time. The Suh reference states that one hundred percent of the fuel being supplied at the time of initial start-up is from the auxiliary gaseous fuel supply. *See Suh*, Col. 4, lines 56-58. Further, Figures 2 and 3 of the Suh reference illustrate that the only fuel that is being fed to the engine at start-up is the gaseous fuel shown as a dotted line. The liquid-phase gasoline is not being supplied to the engine on start-up in the Suh reference. For this additional reason, Applicants request that the rejection of claim 5 be withdrawn.

Dependant claim 10 also distinguishes the present invention from the Shu reference. In particular, claim 10 states that the supply ratio is changed by adding hydrocarbon fuel to provide a second engine torque that exceeds a first engine torque that the optimum fraction can provide. Nothing in the Suh reference teaches or suggest this particular limitation. For this additional reason, Applicants request that the rejection to claim 10 be withdrawn.

Amended claim 11 is directed to a system for fueling an internal combustion engine with a hydrocarbon fuel and a hydrogen-containing fuel gas. The system includes a hydrocarbon fuel supply system and a hydrogen-containing fuel gas supply system. The engine is fueled by an optimum fraction of hydrogen-containing fuel gas at engine start-up and at engine steady-state operating conditions.

The Suh reference does not teach or suggest a system for fueling an internal combustion engine including a hydrogen-containing fuel gas supply system, wherein the engine is fueled by an optimum fraction of hydrogen-containing fuel gas at engine start-up and at engine steady-state operating conditions as recited in amended claim 11. While the engine in the Suh reference may use the gaseous fuel supply during engine start-up, the engine in the Suh reference does not use the gaseous fuel supply after the engine is warmed-up (i.e., steady-state condition). *See Suh*, Col. 4, lines 55-64; Col. 5, lines 14-27. Therefore, the Suh reference does not use an optimum fraction of hydrogen-containing fuel gas at an engine steady-state operating condition. For at least this reason, Applicants request that the rejection of claim 11 be withdrawn. As claims 12-20 depend from claim 11, these claims are also not taught or suggested by the Suh reference for at least the same reason set forth with respect to claim 11.

Dependent claim 16 includes an additional limitation not taught or suggested by the Suh reference. Specifically, claim 16 states that the hydrogen-containing fuel gas is hydrocarbon reformate, and that the hydrogen-containing fuel gas supply system includes a hydrocarbon catalytic reformer. The Suh reference discloses a storage canister (12) for a gaseous fuel, wherein the gaseous fuel travels from the canister (12), through a pressure controller (16), and then is introduced into a plenum (46) using an injector (20). *See Suh*, FIG. 1. The gaseous fuel stored in the canister (12) is not reformed fuel, and does not pass through a reformer before being injected into the engine. *See In re Mills*, 916 F.2d 680, 682, 16 USPQ.2d 1430, 1432 (Fed. Cir. 1990) (stating that the mere fact that the prior art could be so

modified would not have made the modification obvious unless the prior art suggested the desirability of the modification). In fact, the Suh reference does not provide any suggestion or reason for including a hydrocarbon catalytic reformer for reforming the gaseous fuel stored in the canister (12) as the gaseous fuel travels toward the engine. As such, Applicants request that the rejection of claim 16 be withdrawn for this additional reason.

Amended claim 21 is directed to an internal combustion engine fueled by a hydrocarbon fuel and a hydrogen-containing fuel gas. The engine includes a hydrocarbon fuel supply system and a hydrogen-containing fuel gas supply system. The engine is fueled by an optimum fraction of hydrogen-containing fuel gas at engine start-up and at engine steady-state operating conditions.

For at least the same reason set forth with respect to claim 11, the Suh reference does not teach or suggest an internal combustion engine including a hydrogen-containing fuel gas supply system, wherein the engine is fueled by an optimum fraction of hydrogen-containing fuel gas at engine start-up and at engine steady-state operating conditions as recited in amended claim 21. Therefore, Applicants respectfully request that the rejection of claim 21 be withdrawn. As claims 22 and 23 depend from claim 21, these claims are also not taught or suggest by the Shu reference for at least the same reason set forth with respect to claim 21. Applicants request that the rejection of claims 22 and 23 be withdrawn.

New claim 24 depends from claim 1 and includes an additional step of cranking the engine on a mixture of up to 100% of hydrocarbon fuel to optimize engine start-up time. New claim 25 also depends from claim 1 and states that the

amounts of hydrocarbon fuel and hydrogen-containing fuel gas are provided to the engine at engine start-up. New claims 24 and 25 depend from claim 1 and are not taught or suggested by the Suh reference for at least the same reason set forth with respect to claim 1.

Conclusion

In light of the foregoing, Applicants submit that claims 1-25 are in condition for allowance and such allowance is respectfully requested. Should the Examiner feel that any unresolved issues remain in this case, the undersigned may be contacted at the telephone number listed below to arrange for an issue resolving conference.

The Commissioner is hereby authorized to charge the $100.00 required under 37 C.F.R. § 1.16(i) for the two additional claims in excess of 20, and any other fee that may have been overlooked to Deposit Account No. 10-0223.

Respectfully submitted,

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Dennis B. Danella
Reg. No. 46,653

JAECKLE FLEISCHMANN & MUGEL, L.L.P.
190 Linden Oaks
Rochester, New York 14625-2812
Tel: (585) 899-2957
Fax: (585) 899-2931